

JEA LARGE-SCALE CFB COMBUSTION DEMONSTRATION PROJECT

Project Description

An atmospheric circulating fluidized-bed (ACFB) combustor, operating at atmospheric pressure, would repower the Unit 2 steam turbine of the Northside Station. A coal fuel blend (coal/petroleum coke), primary air, and a solid sorbent (crushed limestone) are introduced into the lower part of the combustor where initial combustion occurs. As the coal fuel blend particles decrease in size due to combustion, they are carried higher in the combustor where secondary air is introduced. As the particles continue to be reduced in size, the coal fuel blend, along with some of the sorbent, is carried out of the combustor, collected in a particle separator, and recycled to the lower portion of the combustor. Primary sulfur capture is achieved by limestone in the bed. However, additional SO₂ capture is achieved through the use of a polishing scrubber to be installed ahead of the particulate control equipment.



Steam is generated in tubes placed along the combustor's walls and superheated in tube bundles placed downstream of the cyclone to protect against erosion. The system will produce approximately 2 million lb/hr of main steam at about 2,400 psig and 1,005°F and 1.73 million lb/hr of reheat steam at 600 psig and 1,005°F. The steam will be used in an existing 297.5 megawatt (nameplate) steam turbine and its generator. The heat rate is expected to be approximately 9,950 Btu/kWh (34% efficiency).

Program Goal

Demonstrate ACFB at 297.5 megawatt gross (265 megawatt net) representing a scaleup from previously constructed facilities; verify expectations of the technology's economic, environmental, and technical performance; provide potential users with the data necessary for evaluating a large-scale ACFB as a commercial alternative; accomplish greater than 90% SO₂ removal; and reduce NO_x emissions by 60% when compared with conventional technology.

PARTICIPANTS

JEA

Jacksonville, FL

TECHNOLOGY

Foster Wheeler's Atmospheric Circulating Fluidized Bed (ACFB)

Clinton, NJ

LOCATION

JEA's Northside Station, Unit 2

Jacksonville, FL

TOTAL ESTIMATED COST

\$309,096,512

COST SHARE

DOE \$74,733,833

Participant \$234,362,679



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Project Benefits

ACFB technology has good potential for application in both the industrial and utility sectors, whether for use in repowering existing plants or in new facilities. ACFB is attractive for both baseload and dispatchable power applications because it can be efficiently turned down to 25% of full load. Coal of any sulfur or ash content can be used, and any type or size of coal-fired boiler can be repowered. In repowering applications, an existing plant area is used, and coal and waste-handling equipment as well as steam turbine equipment are retained, thereby extending the life of a plant.

In its commercial configuration, ACFB technology offers several potential benefits when compared to conventional pulverized coal-fired systems: lower capital costs; reduced SO_2 and NO_x emissions at lower costs; higher combustion efficiency; and dry, granular solid material that is easily disposed of or potentially salable.

Accomplishments

The proposed project was resited to Jacksonville after York County Energy partners and Metropolitan Edison Company terminated activities on the ACFB in September 1996. On August 26, 1997, DOE approved the transfer of the ACFB clean coal project from York, PA, to Jacksonville, FL. On September 29, 1997, DOE signed a modified cooperative agreement with JEA to cost-share one (Unit 2) of two units at Northside Generating Station.

The proposed project moves atmospheric fluidized-bed combustion technology to the larger sizes of utility boilers being considered in capacity additions and replacements. The nominal 300-megawatt demonstration unit in the JEA project will be more than double the size of the Nucla unit (110-megawatt). Features include an integrated recycle heat exchanger (INTREX™) in the furnace, steam-cooled cyclones, a parallel pass reheat control, an SO_2 polishing scrubber, and a fabric filter for particulate control. Expected environmental performance is 0.15 lb SO_2 /10⁶ Btu, 0.09 lb NO_x /10⁶ Btu, and 0.011 lb particulates/10⁶ Btu (0.013 lb PM_{10} /10⁶ Btu).

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